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ABSTRACT

An exploratory factor analysis is used in the study of institutional preferences in medical student admissions. Sources and mathematical derivations of 58 institutional variables are presented. Most of the measures describe attributes related to the admission process. The remainder were selected to represent other dimensions along which medical schools have been observed to vary. The data for 86 established schools were submitted to principal component analysis. From several resulting factor patterns, the most interesting pattern is reported and interpreted. The analysis is exploratory in nature, designed to enhance understanding of new data and their potential usefulness for developing and testing hypothesis concerning institutional variation in admissions preferences. Abbreviations used in variable labels and interpretation of the factor pattern matrix are included in the appendices. (SPG)

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A THIRD EXPLORATORY ANALYSIS OF THE RELATIONS AMONG INSTITUTIONAL VARIABLES: A STUDY OF INSTITUTIONAL PREFERENCES IN MEDICAL STUDENT ADMISSIONS

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
NATIONAL INSTITUTE OF EDUCATION

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FINAL REPORT

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A THIRD EXPLORATORY ANALYSIS OF THE RELATIONS AMONG INSTITUTIONAL VARIABLES: A STUDY OF INSTITUTIONAL PREFERENCES IN MEDICAL STUDENT ADMISSIONS

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ASSOCIATION OF AMERICAN MEDICAL COLLEGES

FINAL REPORT

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EXECUTIVE SUMMARY

The present report, A Third Exploratory Analysis of the Relations Among Institutional Variables: A Study of Institutional Preferences in Medical Student Admissions, is one in a series of studies examining the characteristic ways in which U.S. medical schools are similar and different. The focus of this study is on medical student admissions as viewed from an institutional, not individual, perspective.

Using aggregations of data from applicants and matriculants, several new institutional measures are derived that may indicate direct or indirect institutional preferences or may describe other characteristics and outcomes of schools' admissions programs. Together with several additional institutional variables, these measures are intercorrelated and submitted to a principal components analysis.

Among the tentative observations that were made are:

- Schools that accept the most highly academically qualified students are likely to have a research emphasis. Selected students are less likely to be re-applicants or holders of advanced degrees. Their graduates are more likely to serve on medical school faculties.
- Selectivity on MCAT scores appears to be related to size of undergraduate medical program. It may be that schools that process the largest numbers of applications place greater reliance on test scores for initial screening. This observation is due, in part, to the nature of the measures used. There were weak indications that these schools graduate smaller proportions of persons who will deliver primary care.
- Private schools are more likely than public schools to enroll students whose fathers are medical doctors. This is independent of another principal component that describes the academic preparation of new students.
- Public medical schools may be more likely than private schools to enroll students desiring careers in primary care or contemplating practice in small or rural places. More of their students also tend to be from small towns.

- Schools where admission competition among applicants is greatest are schools that appear to compete among themselves for the best students. These schools offer more acceptances for each opening they have to fill. These tend to be private schools.

- Although the results are tenuous, it appears that well-established schools that have recently expanded their enrollments are schools that have higher percentages of women enrolled. It could be that accommodation was made for increasing numbers of women partly through expansion rather than substitution.

- Schools that admit greater proportions of minorities currently underrepresented in medicine appear to give less importance to grade point averages as an admission criterion.

Recommendations for further study are made in the final section of the report.

Chapter I

INSTITUTIONAL PREFERENCE IN MEDICAL STUDENT ADMISSIONS

Introduction

The demand for medical education grew dramatically during the last decade. The numbers of medical schools and openings for first-year students also increased substantially, but not in proportion to the demand. As opportunities for medical education increased and became increasingly competitive, the admissions process and the characteristics of medical school applicants and matriculants became subjects of more intensive study than in the past (Cuca, et al., 1976).

In the most recent in a series of annual descriptive studies of medical school applicants, it was observed that an applicant's chance of admission in 1976-77 was 37.4 percent. In 1976-77, 42,155 persons filed 372,282 applications. Each applicant applied to an average of 8.83 schools. The recent growth in application activity was observed in the study to be tapering off. A decreased proportion of all applicants were applying for the first time. Increased proportions of applicants were women and members of minority groups also underrepresented in medicine. The proportion of applicants indicating aspirations to careers delivering primary care was observed to have increased. A majority of applicants indicated a desire to locate their practices in places with small populations, presumably places currently underserved by the health care system in the United States (Gordon, 1977).

Institutional Perspective

The changes and other characteristics listed above describe the total pool of applicants to U.S. medical schools. Each of the 116 schools, however, received applications from different subsets of this pool. As medical schools have been observed, in other institutional studies, to differ with respect to research intensiveness, graduate medical education involvement, and other basic characteristics, so they may be expected to vary in their preferences for students with particular personal and educational backgrounds. Although the desired outcome of the many undergraduate medical programs may be the same, different institutions may start with a different profile or mix of types of student.

This is an exploratory study of medical school admissions from an institutional perspective. Using aggregations of data from all applicants and matriculants for a given school, new institutional measures are derived that may indicate direct or indirect institutional preferences or may describe other characteristics and outcomes of the school's admissions process. Such measures may, or may not, serve to differentiate among schools. The present study presents the pattern of correlations among the new measures, and between the new measures and other known attributes of medical schools.

Background

Since 1975, the Association of American Medical Colleges (AAMC) has conducted an ongoing series of studies examining the quantified characteristics of medical schools in the United States. Available data from a number of different sources are routinely collected and stored by the AAMC. The major portion of the data used in these studies is accumulated annually through the student application and institutional research activities of the AAMC and the Liaison Committee on Medical Education (LCME).

Using multivariate statistical methods, the studies in this series examine and re-examine several questions: In what basic ways are medical schools similar and different? What groups of schools are similar to one another? What is the global picture of institutional similarity with respect to specific characteristics? Some of the more recent studies in the series are listed in the Bibliography.

This is the first exploratory institutional study in the series to focus on data from the admissions process. It presents an analysis of the interrelations among 58 institutional measures. A related new report presents the results of cluster analysis and multidimensional scaling of medical school similarities with respect to 17 of these measures (Sherman and McShane, 1977).

Exploratory Objectives

The goal of the present study is not to answer specific research questions by empirically testing formal hypotheses. The goal is, rather, to explore the available data for evidence of possible relationships that may exist among data that are descriptive of medical

schools and medical school admissions. To do this one might consider examining the correlation coefficients describing each relationship between all pairs of variables. Given a large number of variables, the problem of examining all such possible pairwise relationships is prohibitive. Assuming, however, that some form of structure exists among the complete set of intercorrelations of variables, and that the proper variables have been adequately measured, the task may be seen as a proper application for exploratory factor analysis. In the words of one of the pioneers of this method:

> When a particular domain is to be investigated by means of individual [for our purposes, "institutional"] differences, one can proceed in one of two ways. One can invent a hypothesis regarding the processes that underlie the individual ["institutional"] differences, and one can then set up a factorial experiment or a more direct laboratory experiment, to test the hypothesis. If no promising hypothesis is available, one can represent the domain as adequately as possible in terms of a set of measurements or numerical indices and proceed with a factorial experiment. The analysis might reveal an underlying order which would be of great assistance in formulating the scientific concepts covering the particular domain. In the first case we start with a hypothesis that determines the nature of the measurements that enter into the factorial analysis. In the second case, we start with no hypothesis, but we proceed, instead, with a set of measurements or indices that cover the domain, hoping to discover in the factorial analysis the nature of the underlying order. It is this latter application of the factorial methods that is sometimes referred to as an attempt to lift ourselves by our own bootstraps, because the underlying order in a domain can be discovered without first postulating it in the form of a hypothesis. This is probably the characteristic of factor analysis that gives it some interest as general scientific method. (Thurstone, 1947, p. 55)

Henrysson (1960) adds that "explorative factor analysis is to be used primarily in the mapping of a field about which we have little knowledge or developed theories.

The results of such analysis can then be used for formation of more rigorous hypotheses and in planning experiments" (p. 92). Mulaik (1972) also cites the value of exploratory factor analysis in generating hypotheses but acknowledges its limitations as a source of theory:

> Factor analysis can ultimately only provisionally establish its common factors as causal mechanisms accounting for the relationships among variables. Here factor analysis must give ground to experimental or observational techniques in which the research has direct control or observation of the crucial independent variables. Still one can think of many situations in the behavioral, social, and economic sciences in which direct control and observation of the crucial parameters are and will continue to be highly difficult to achieve, and it is in such situations that we expect factor analysis will continue to make valuable contributions (p. 362).

Principal components analysis, the form of factor analysis performed in the present study, is esssentially a way of grouping variables that tend to correlate with one another. The number of patterns of correlations within and among groups of variables is smaller and more manageable for examination, interpretation, and possible hypothesis generation than would be the full correlation matrix. As such it is ideally suited to overcoming the problem of "too much data" and meeting the present exploratory objectives.

The present use of exploratory techniques is not intended to imply that nothing is known about medical school admissions. The present institutional study serves to supplement other more focused "special studies" also performed by AAMC on various aspects of medical education.

Overview

Sources and mathematical derivations of 58 institutional variables are presented in the next chapter. Most of the measures describe attributes related to the admissions process. The remainder were selected to represent other dimensions along which medical schools have been observed to vary. The data for 86 established schools were submitted to principal components analysis. From

several resulting factor patterns, the most interesting pattern is reported and interpreted in Chapter III. The analysis is exploratory in nature, designed to enhance understanding of new data and their potential usefulness for developing and testing hypotheses concerning institutional variation in admissions preferences.

Chapter II

METHOD

Methodological considerations for this study include definition of variables, selection of institutions, and principal components analysis. Each of these will be discussed in this chapter.

Data Sources and Variable Definitions

Data used to derive the measures used in this study were extracted from the AAMC's Institutional Profile System (IPS). Most of the data stored in this data base are provided by the medical schools on the annual LCME Questionnaires, Part I (financial information) and Part II (student, faculty, and program information). Additional data are aggregated from the Medical Student Information System (MSIS) and the Faculty Roster System (FRS) to provide institutional-level descriptions of applicants, students and faculty. Other data come from published sources, from the Division of Research Grants at the National Institutes of Health, and from special surveys of the schools conducted by the AAMC.

The focus of this exploratory study is on medical school admissions. While some variables used describe a variety of general attributes of medical schools, most of the variables analyzed in this study stem from data provided by potential medical students at the time they take the Medical College Admissions Test (MCAT) and on their applications for admission to medical school in 1976-77 via the AAMC's American Medical College Application Service (AMCAS).

The data from individuals were tallied, averaged or otherwise summarized to become institutional variables. Some of the institutional variables were further transformed into percentages, odds, odds ratios, and difference indices for use in the analysis to reflect additional characteristics of each school's admissions program.

The measures for each school derived from MSIS for use in the analysis are:

A. Means. The mean MCAT-Science score for all matriculants and the Mean MCAT-Verbal score for all matriculants reflect the level of academic aptitude and preparation of the entering class.

B. Standard Deviations. The standard deviations of the MCAT-Science and MCAT-Verbal scores for all matriculants reflect the variability in the level of academic preparation of the entering class.

C. Admission Odds. The admission odds is defined as:

$$\frac{\text{Number of Matriculants}}{\text{Number of applicants-Number of matriculants}}$$

This reflects the overall likelihood that an applicant would matriculate at the school.

Note: This is not "acceptance odds," since not all accepted applicants matriculate. Indeed, many are accepted by more than one school. A better term may have been "matriculation odds."

D. Admission Odds Ratios. The admission odds ratios are derived in two steps. The admission odds for persons with a particular characteristic is defined as:

$$\frac{\text{Number of matriculants with characteristic x}}{\text{Number of non-matriculating applicants with x,}}$$

where "characteristic x" might represent, for example, being a biology undergraduate major. Such a measure, not used directly in the analysis, would reflect the likelihood that an applicant with a particular attribute would matriculate in the school. The admission odds ratio for a particular characteristic is defined as:

$$\frac{\text{Admission odds for applicants with characteristic x}}{\text{Admission odds for all applicants}}$$

The odds ratio reflects the effective relative preference of the school for applicants who possess the given characteristic. (The measure may also reflect, to some degree, the relative preference of applicants to accept a place at that school.) Values greater than 1.0 reflect preference for persons having the given characteristic. Values less than 1.0 reflect preference for persons without the character-

istic. Values about equal to 1.0 reflect effective indifference. Characteristics for which institutional odds ratios were computed include:

- being female
- being Black, American Indian, Chicano, or Mainland Puerto Rican
- holding an advanced degree
- majoring in biology or "pre-med"
- majoring in humanities or arts
- majoring in physics or math
- majoring in social sciences
- having taken the MCAT only once
- desiring career in general/primary care
- desiring career in research and/or teaching
- planning to specialize in a primary care field
- planning to specialize in basic medical sciences
- contemplating practice in small city (less than 2,500) or small town (less than 50,000)
- having a father who had graduate or professional education
- having a father who is an M.D.
- having been raised in a small city or town
- having applied to a medical school in previous years.

These measures may not necessarily indicate an institution's relative preference for (or self-selection by) persons possessing these characteristics. These measures may simply be related to other characteristics that are of immediate relevance to an admissions committee's assessment of an applicant's potential. The effective result is measured by the odds ratio.

Odds ratios are independent of two potential sources of bias, an unusual proportion of the school's applicant pool having a given characteristic, and an unusual number of applicants for each opening.

E. Percentage of Matriculants. The percentage of matriculants at each school who have a certain characteristic is defined as:

$$\frac{100 \times \text{number of matriculants with the characteristic}}{\text{number of matriculants}}$$

Such percentages describe the outcome of the admissions process. They are not independent of possibly unbalanced characteristics of the school's applicant pool. They are independent of the number of applications for each opening. Percentages of matriculants were computed for the following characteristics:

- being female
- being Black, American Indian, Chicano, or Mainland Puerto Rican
- holding an advanced degree
- having majored in biology or "pre-med"
- having majored in humanities or arts
- having majored in physics or math
- having majored in a social science
- having taken the MCAT more than once
- desiring a career in general/primary care
- desiring a career in research and/or teaching
- planning to specialize in basic medical science
- contemplating practice in a small city or small town
- having a father who had graduate or professional education
- having a father who is an M.D.
- having been raised in a small city or small town
- having been rejected by medical schools in previous years
- having also been accepted by another medical school

F. Indices of Difference. For four applicant characteristics that were more continuous than categorical in their original measurement, indices of the difference between each school's applicant pool and matriculating class were computed. The four characteristics are:

- age
- MCAT-Science score
- MCAT-Verbal score
- Grade Point Average for courses in biology, chemistry, physics and math.

The index for each characteristic (except age) was defined as follows:

$$\text{INDEX} = \frac{\bar{x}_{\text{MATR}} - \bar{x}_{\text{APPL}}}{\sqrt{\frac{s^2_{\text{MATR}}}{N_{\text{MATR}}} + \frac{s^2_{\text{APPL}}}{N_{\text{APPL}}}}}$$

where MATR means matriculants, APPL means applicants, $\bar{x}$ is the mean, s^2 is the variance, and N is the number of applicants or matriculants, depending on the subscript. In the case of age, the difference in the numerator is reversed and computed as mean age of applicants minus mean age of matriculants. The index is related to the t-statistic. All matriculants, of course, were applicants, and the two groups overlap. It is expected that this would lead to an index that is smaller and more conservative, than would be a truly independent t-statistic. A large value (relative to another school's value) of an index would indicate relatively greater effective discrimination with respect to the given characteristic. The The measures do not necessarily indicate that schools discriminate among applicants on the basis of these characteristics. The characteristics may be related to other attributes that are carefully considered. (The means of these four indices for all schools seem to indicate that, in the selection of students, schools pay most attention to grades, MCAT-Science next, MCAT-Verbal third, and age least.)

G. Ratio of Acceptances to Matriculants. Medical schools recognize that most applicants apply to several schools and that the more highly qualified applicants receive competing offers of acceptance. Schools, therefore, send notices of acceptance to more persons than they expect to matriculate. The experience of each school is different. The ratio of acceptance offers to matriculants may or may not measure the

relative attractiveness of the schools to applicants. Schools with lower values may be considered more attractive to its applicants. The percentage of matriculants who were also accepted elsewhere, defined above in paragraph E, is another potential measure of institutional attractiveness used in this study.

H. Participation in AMCAS. The American Medical College Application Service (AMCAS) enables applicants to apply to several medical schools with a single application form. The convenience and financial incentive of this service sometimes result in greater numbers of applications per opening filed at schools that participate in the AMCAS program. Participation versus non-participation was coded as a binomial institutional variable and included in the analysis to signal possible artifactual bias in the results. Examination of the means of 58 variables for 19 AMCAS schools and for 65 non-AMCAS schools revealed several significant differences between the two groups. Preliminary results of multivariate analyses, however, revealed no major difference in the overall patterns of correlations among these variables for all schools' data and for AMCAS schools' data analyzed separately.

In addition to the measures derived from MSIS to reflect institutional characteristics of the admissions process, several measures of other institutional characteristics were included in the analysis. The additional variables were included to explore the possibility that other institutional attributes may be related to admissions. Selected variables describe:

A. Alumni Characteristics. Data published by the American Medical Association were used to compute, for each school's graduates of the 1960's, (1) the percentage in patient care, (2) the percentage in general practice, internal medicine or pediatrics, and (3) the percentage teaching or doing research. Data from the Faculty Roster System were used to estimate the

percent of alumni serving full-time on the faculty of any medical school as of 1977.

B. Residency Programs. From data provided by the schools to a special AAMC survey, the percentage of residency positions in general, family, internal or pediatric medicine was computed. The ratio of the number of housestaff positions to undergraduate medical students was also included in the analysis.

C. Medical Program Size. The number of undergraduate medical students and the amount of regular operating revenues were included in the analysis. These variables were used to signal possible effects of program size on the admissions process.

D. Research. The relative extensiveness of a school's research involvement was represented by the percentage of total expenditures for sponsored research. Another aspect of the research environment was represented by the mean priority score assigned by NIH (standardized within study section) to all single-investigator (RØ1) research grant applications submitted from the medical school in FY 1976.

E. Development. The annual rate of growth in numbers of first-year students from 1970 to 1975 was used in the analysis.

F. Control. A binomial variable, coded 0.0 for publicly controlled schools and 1.0 for private schools, was used in the analysis to identify variation in admissions characteristics that may be related, directly or indirectly, to a school's type of ownership and control.

Table 1 presents a list of all variables used in the analysis with the means, medians and standard deviations of data for all 84 schools used in the analysis. The selection of schools described by these data is detailed below. A glossary of abbreviations used in the variable labels is presented in Appendix A. Complete descriptions of the sources and computation for each variable are available in an appendix of Institutional Characteristics of U.S. Medical Schools, 1975-76 (Agro, et al., 1977). The six-character code may be used for cross-reference.

TABLE 1

MEDIANS, MEANS, AND STANDARD DEVIATIONS OF
58 VARIABLES DESCRIBING 84 U.S. MEDICAL SCHOOLS

VARIABLE	LABEL	MEDIAN	MEAN	STANDARD DEVIATION
STR368	MEAN MCAT.VERBAL SCORES OF MATRC.TOTAL	576.18	573.09	36.09
STR371	MEAN MCAT.SCIENCE SCORES OF MATRC.TOTAL	624.45	620.37	34.12
STR372	STD DEV MCAT.VERBAL MATRC.TOTAL	77.93	77.78	7.38
STR375	STD DEV MCAT.SCIENCE MATRC.TOTAL	64.57	65.49	8.58
STC126	ADMISSION ODDS	0.04	0.08	0.08
STC129	ADMISSION ODDS RATIO IF FEMALE	1.01	1.02	0.20
STC134	ADMISSION ODDS RATIO IF UNDERREP MINOR.	0.80	0.88	0.51
STC136	ADM ODDS RATIO FOR ADV DEGREE HOLDERS	0.63	0.76	0.89
STC138	ADM ODDS RATIO FOR PREMED & BIOL MAJORS	0.96	0.96	0.12
STC140	ADM ODDS RATIO FOR HUMAN & ARTS MAJORS	0.95	1.05	0.67
STC142	ADM ODDS RATIO FOR PHYS SCI & MATH MAJOR	1.14	1.19	0.35
STC144	ADM ODDS RATIO FOR SOCIAL SCIENCE MAJORS	0.82	0.82	0.27
STC147	ADM ODDS RATIO IF MCAT TAKEN ONLY ONCE	1.25	1.24	0.18
STC151	ADM ODDS RATIO FOR CAREER AS GP	0.94	0.91	0.20
STC153	ADM ODDS RATIO FOR CAREER IN RES & TCH	0.92	1.00	0.63
STC157	ADM ODDS RATIO IF SPEC IN PRIMARY CARE	0.97	0.95	0.15
STC159	ADM ODDS RATIO FOR BASIC SCIENCE SPECLTN	0.87	0.95	0.58
STC161	ADM ODDS RATIO IF INDIC PRAC IN SM PLACE	1.02	0.99	0.22
STC163	ADM ODDS RATIO IF FATH HAD GRD OR PRF ED	1.07	1.09	0.15
STC167	ADM ODDS RATIO IF FATHER IS MD	1.09	1.15	0.39
STC169	ADM ODDS RATIO IF RAISED IN SMALL LOC	1.03	1.03	0.23
STC171	ADM ODDS RATIO FOR RE-APPLICANTS	0.77	0.81	0.34
STC172	% MATRICULANTS WHO ARE FEMALE	23.43	24.35	7.21
STC173	% MATRICULANTS FROM UNDERREP MINORITIES	6.29	8.65	10.19
STC174	% MATRICULANTS HOLDING ADVANCED DEGREES	7.87	8.57	4.61
STC175	% MATRICS MAJORED IN BIOLOGY OR PREMED	60.49	60.00	9.79
STC176	% MATRICS MAJORED IN HUMANITIES AND ARTS	3.03	3.59	2.77
STC177	% MATRICS MAJORED IN PHYS SCI & MATH	20.67	22.14	7..
STC178	% MATRICS MAJORED IN SOCIAL SCIENCES	8.83	8.60	3.03
STC179	% MATRICS WHO TOOK MCAT MORE THAN ONCE	34.00	35.46	13.68
STC180	% MATRICS SEEKING CAREER IN RES & TCH	20.13	22.10	9.45
STC181	% MATRICS SEEKING PRIMARY CARE PRACTICE	46.29	45.30	9.75
STC182	% MATRICS SEEKING SPCLZN IN BASIC SCI	1.72	2.06	1.53
STC183	% MATRICS WANTING TO LOCATE IN SM PLACE	45.68	45.52	14.92
STC184	% MATRICS FATHERS HAVE GRAD OR PROF EDUC	37.15	39.06	7.10
STC186	% MATRICS HAVING MD FATHERS	13.77	14.86	5.21
STC187	% MATRICS RAISED IN SMALL LOCATION	35.25	38.22	13.70
STC188	% MATRICS WHO RE-APPLIED TO MED SCHOOL	19.31	20.89	9.83
STC189	% MATRICS WHO WERE ALSO ACCEPTED ELSEWHR	26.91	34.46	24.68
STC013	% 1ST-YR MD STUD:PRE-MED GPA 3.6-4.0	46.77	47.15	15.76
STC030	INDEX OF APPL-MATR AGE DIFFERENCE	3.24	3.40	2.74
STC045	INDEX OF MATR-APPL BCPM GPA DIFFERENCE	8.68	8.73	4.66
STC148	INDEX OF MATR-APPL MCAT-VERBAL DIFF	3.57	3.65	3.11
STC149	INDEX OF MATR-APPL MCAT-SCIENCE DIFF	6.24	6.56	3.86
STC191	RAT: ACCEPTANCE OFFERS PER ENTERING STUD	1.56	1.66	0.44
INR172	MED-SCHOOL.IN AMCAS IN 76-77 (1=YES,0=NO)	0.85	0.77	0.42
STC121	AMA:% 60-69 GRADS IN PATIENT CARE	91.26	89.90	5.06
STC120	AMA:% 60-69 GRADS IN GP IM OR PED	33.30	33.81	4.91
STC192	AMA:% 60-69 ALUMNI DOING RESEARCH OR TCH	5.51	6.86	4.21
STC113	FRS:AMA EST % ALUMS ON FT FAC OF ANY SCH	5.07	6.15	3.17
STC119	% ALL 75-6 RESDNTS IN GP FM IM OR PED*	38.40	37.80	16.50
STC043	RAT:HOUSESTAFF TO UNDERGRAD MD STUD	0.70	0.79	0.44
STR009	# UNDERGRADUATE MEDICAL STUDENTS	556.50	583.80	179.89
INC089	REG OPER REV - ADJ TOT MINUS SPONS($1000)**	16061.85	18417.25	8622.00
INC017	% TOTAL EXPD FOR SPON RESEARCH	21.88	23.01	11.18
INR142	NIH R01 GRANTS: MEAN STD PRIORITY SCR	0.07	0.11	0.40
STC190	1ST-YR CLASS ANNL GROWTH RATE 1970-75(%)	3.87	4.68	3.10
INR002	CONTROL: 0=PUBLIC, 1=PRIVATE	0.48	0.49	0.50

* Data available for 77 schools.

** Data available for 81 schools.

The approximate correspondence between the institutional admissions statistics and the statistics that best describe admissions from the perspective of the individual applicant may be demonstrated as follows. Values of the admissions odds among schools range from .01 to .37. The mean value is .082 (equivalently about 8:100 or 1:12.5), the median is .041. The median (or other overall estimate) admission odds of .041 may be transformed into the probability that an applicant applying to one school will matriculate at that school: .041 ÷ (1 + .041) = .039. The probability of not matriculating at one school, then, is (1 - .039) = .961. In 1976 the average applicant applied to 8.83 schools. The probability of being rejected by all of the schools is .961 raised to the 8.83 power, = .70. The probability of being accepted by (and presumably matriculating at) only one school is equal to one minus the probability of not matriculating at any school, 1 - .70 = .30. This number derived from the median odds ratio, approximates the 37.4 percent admissions rate for individual applicants. The correspondence is only approximate. Starting with 37.4 percent and working backwards through the arithmetic yields an estimated odds ratio of .0545, a value between the mean (.082) and the median (.041).

Selection of Schools

Based on the experience of previous institutional studies in this series, it was believed that a pattern in the correlations among the set of new variables would be most easily detected if the schools analyzed were limited to older, established schools. Established schools are more likely to have complete and stable data.

The 84 fully accredited medical schools, granting M.D. degrees before 1967 were selected for analysis.

Principal Components Analysis

Principal components analysis is one of several data reduction procedures known generally as "factor analysis." The aim is to reduce the entire matrix of correlation coefficients between all pairs of variables into a smaller, more easily decipherable matrix without losing much of the information about how well pairs of variables are related. The smaller matrix of numbers, called a "factor pattern matrix," may be used to see how related variables may be grouped together and distinguished from less strongly or

unrelated variables.

In the present study the 58-by-58 matrix of correlation coefficients was computed allowing each coefficient to be based on as many paired observations as were available. Since some data were missing for some medical schools, different coefficients were based on different numbers of pairs. The diagonal elements in the correlation matrix contained "1's," the correlations of each variable with itself. The matrix was "factored" initially into 14 components (the number having eigenvalues greater than unity) accounting for 81.3 percent of the variance in the full matrix. Separate varimax rotations were performed on the initial 14, 13, 12, 11, 10, 9, and 8 components. Of these, the thirteen component solution, accounting for a total of 79.3 percent of total variance, was the most interpretable and was chosen for closer examination, presentation and interpretation.

Chapter III

RESULTS AND DISCUSSION

Thirteen Component Factor Pattern

As a result of the procedures outlined in the previous chapter, thirteen numbers called "factor loadings" were derived for each of the 58 variables analyzed. The absolute value of the loadings represents the degree to which individual variables belong to each of thirteen groupings of variables. The set of factor loadings is arrayed in a "factor pattern matrix" having one row for each variable and one column for each "principal component" or grouping of variables.

The thirteen component rotated factor pattern matrix is presented in Table 2. The rows of the matrix have been sorted to facilitate the identification of variables that grouped together on the basis of their mutually high intercorrelations. The largest values (in absolute value) in each row, and other large values have been accentuated by "boxes"; moderate values have been marked with asterisks. To the right of each row is the communality of each variable, h^2, equal to the sum of squares of the values in each row. These numbers reflect the degree to which the information carried by each variable is contained in all rotated components.

As a preliminary example of the interpretation of the numbers in the matrix, consider the first row. From AMA records, the percentage of graduates of the 1960's who are now doing research or teaching, the variable labeled "STC192," is seen as strongly related to the first group of variables since its value in the first column is large (.84). It is related to some general characteristic common to all variables in group one, perhaps a research emphasis or prestige in the eyes of academically well qualified applicants. It is unrelated to the general characteristics underlying each of the other twelve components since (looking across the first row) its "loadings" on those components are all very small. The sixth variable in the first group, the percentage of matriculants indicating, at the time of the qualifying exam, that they would like to pursue careers in medical research or teaching, is related most strongly to the first group of variables (.66) but is also inversely related to the seventh group (-.52). This is

TABLE 2

THIRTEEN COMPONENT VARIMAX FACTOR PATTERN RESULTING FROM
PRINCIPAL COMPONENTS ANALYSIS OF 58 VARIABLES
DESCRIBING 84 U.S. MEDICAL SCHOOLS

VARIABLE	LABEL	1 RESEARCH ORIENTATION	2 SIZE AND CHOICE	3 BIOLOGICAL VS. PHYSICAL SCIENCE MAJORS	4 FATHER'S EDUCATION/ OCCUPATION	5 SOCIAL SCIENCE & HUMANITIES MAJORS	6 RE-APPLICANTS	7 PATIENT CARE ORIENTATION	8 ADMISSION ODDS/ CONTROL TYPE	9 VARIATION IN ACADEMIC PREPARATION	10 WOMEN & GROWTH	11 BASIC SCIENCE SPECIALIZATION	12 RESIDENCIES IN PRIMARY CARE	13 MINORITY REPRESENTATION	h^2
STC193	AMA:% 60-69 ALUMNI DOING RESEARCH OR TCH	.84	-.02	.01	-.15	.06	-.13	-.26	-.05	-.19	-.03	.14	-.08	.12	.89
STC121	AMA:% 60-69 GRADS IN PATIENT CARE	-.83	.05	-.02	.13	-.03	.14	.29	.02	.19	-.02	-.10	.04	-.19	.90
STC113	PRELIMPA EST % ALUMS ON FT FAC OF ANY SCH	.77	-.05	.04	-.18	.04	-.22	-.17	-.15	-.21	.01	.30	-.14	.05	.84
STC189	% MATRICS WHO WERE ALSO ACCEPTED ELSEWHERE	.74	.05	.02	-.06	.06	-.20	-.34	.17	.02	-.19	.18	-.11	.15	.84
INC017	% TOTAL EXPD FOR SPON RESEARCH	.72	.03	.08	-.12	.11	.28	-.18	.19	.10	-.05	.01	.02	-.02	.65
STC190	% MATRICS SEEKING CAREER IN RES & TCH	.66	-.07	-.02	-.14	-.22	-.06	-.52	.09	-.05	-.05	.20	-.14	.11	.87
STC348	MEAN MCAT.VERBAL SCORES OF MATRC.TOTAL	.55	.36	.07	-.05	.26	-.10	-.19	.40*	-.05	-.11	.05	-.08	-.18	.89
STC371	MEAN MCAT.SCIENCE SCORES OF MATRC.TOTAL	.62	.41*	.11	.02	.04	-.21	-.16	.48*	-.03	-.10	.02	-.08	-.23	.92
STC043	RAT:HOUSESTAFF TO UNDERGRAD MD STUD	.62	.02	.14	.11	-.01	.13	-.10	.16	.17	-.13	.01	.15	.06	.54
INR142	NIH R01 GRANTS: MEAN STD PRIORITY SCR	-.62	-.22	-.00	.16	.21	-.03	.16	.08	-.31	.04	.15	-.16	.29	.76
STC179	% MATRICS WHO TOOK MCAT MORE THAN ONCE	-.61	-.19	-.07	-.00	.00	.56	.16	-.32	.03	.06	.02	-.14	-.06	.87
STC013	% 1ST-YR MD STUDS WHO HAD GPA 3.6-4.0	-.47	-.38*	.24	.06	-.16	-.07	-.03	-.06	-.08	-.06	.14	-.08	-.26	.67
STR009	# UNDERGRADUATE MEDICAL STUDENTS	-.21	.75	-.25	.00	.05	-.02	-.11	-.14	.12	.12	-.01	.03	.00	.73
STC149	INDEX OF MATR-APPL MCAT-SCIENCE DIFF	.22	.66	.10	.26	-.17	-.18	-.12	-.02	-.33	-.04	-.04	.08	-.28	.84
STC148	INDEX OF MATR-APPL MCAT-VERBAL DIFF	.38*	.66	.05	.17	.21	-.09	-.19	.05	-.25	-.10	-.01	.03	-.24	.84
INC089	REG OPER REV - ADJ TOT MINUS SPONS	.45*	.64	.09	.10	.07	-.05	-.00	-.16	.06	-.08	.23	.08	.13	.74
STC120	AMA:% 60-69 GRADS IN GP IM OR PED	-.12	-.46	-.05	.23	-.01	.04	.19	-.21	-.20	.03	.20	.44*	-.13	.62
STC177	% MATRICS MAJORED IN PHYS SCI & MATH	.10	-.06	.92	-.06	-.14	-.04	.04	-.06	-.05	.01	.13	-.06	-.04	.92
STC142	ADM ODDS RATIO FOR PHYS SCI & MATH MAJOR	.01	-.07	.92	-.00	-.19	-.05	.10	.04	-.12	.02	.03	.06	-.03	.92
STC138	ADM ODDS RATIO FOR PREMED & BIOL MAJORS	-.08	-.05	-.90	.01	-.30	.08	.03	.01	.00	.11	.09	.01	.04	.93
STC175	% MATRICS MAJORED IN BIOLOGY OR PREMED	-.17	-.07	-.87	.05	-.36	.10	.05	.01	-.05	.07	.01	.04	.02	.94
STC186	% MATRICS HAVING MD FATHERS	.02	-.06	.07	-.92	.04	.04	-.05	.06	-.07	-.13	-.00	.02	-.12	.89
STC167	ADM ODDS RATIO IF FATHER IS MD	-.07	-.09	.01	-.89	-.04	.03	-.06	.00	-.19	-.01	-.07	.09	.08	.88
STC163	ADM ODDS RATIO IF FATH HAD GRD OR PRF ED	.16	.01	-.00	-.86	.04	.06	-.18	.02	-.05	.16	-.02	-.04	.08	.83
STC184	% MATRICS FATHERS HAVE GRAD OR PROF EDUC	.41*	.02	.03	-.78	.05	.03	-.20	.13	.04	.06	.03	-.10	-.11	.87
STC144	ADM ODDS RATIO FOR SOCIAL SCIENCE MAJORS	-.05	.04	.05	.04	.89	.10	.13	.00	-.00	.05	.11	-.04	-.04	.85
STC170	% MATRICS MAJORED IN SOCIAL SCIENCES	-.01	.02	.02	-.03	.88	.13	.08	.11	.01	.13	.06	.01	-.01	.83
STC176	% MATRICS MAJORED IN HUMANITIES AND ARTS	.33	.03	.09	-.23	.58	.00	-.14	-.12	.19	-.40*	-.17	.01	.19	.80
STC140	ADM ODDS RATIO FOR HUMAN & ARTS MAJORS	.05	.02	.17	-.04	.54	.02	.03	-.33	.02	-.53	-.15	-.11	.15	.76
STC171	ADM ODDS RATIO FOR RE-APPLICANTS	-.32	.01	-.18	-.12	-.04	.79	.11	-.17	.03	.06	-.14	.10	-.11	.86
STC188	% MATRICS WHO RE-APPLIED TO MED SCHOOL	-.49*	-.02	-.12	-.08	-.06	.72	.13	-.22	.03	.06	-.10	.13	-.14	.90
STC130	INDEX OF APPL-MATR AGE DIFFERENCE	-.22	.30	-.05	-.08	-.29	.68	-.05	-.03	-.08	.10	.08	-.03	-.22	.77
STC147	ADM ODDS RATIO IF MCAT TAKEN ONLY ONCE	.19	.13	.23	.10	-.04	-.67	-.01	.17	-.09	-.15	-.07	.34	-.03	.75
STC136	ADM ODDS RATIO FOR ADV DEGREE HOLDERS	.02	-.02	.02	-.10	.34	.54	.03	.23	-.12	-.09	-.15	.03	-.02	.53
STC174	% MATRICULANTS HOLDING ADVANCED DEGREES	.10	.10	.07	.25	-.01	.49	.11	-.01	.27	-.28	.02	.21	.10	.54
STC169	ADM ODDS RATIO IF RAISED IN SMALL LOC	-.04	-.18	.09	-.02	-.07	-.15	.83	-.23	.07	-.11	.07	.05	-.06	.84
STC161	ADM ODDS RATIO IF INDIC PREC IN 4TH PLACE	-.29	-.14	-.09	.06	.02	.03	.83	-.08	.13	.11	-.06	.12	-.16	.87
STC157	ADM ODDS RATIO IF SPEC IN PRIMARY CARE	-.22	.03	-.01	.30	.03	.28	.78	.03	.10	.19	-.06	-.02	.12	.84
STC151	ADM ODDS RATIO FOR CAREER AJ GP	-.25	.03	-.05	.13	.09	.14	.78	.16	.11	.14	-.15	-.02	.11	.83
STC181	% MATRICS SEEKING PRIMARY CARE PRACTICE	-.45*	.03	.08	.23	.07	.21	.75	-.08	.06	.06	-.09	.05	-.01	.89
STC183	% MATRICS WANTING TO LOCATE IN 1 PLACE	-.39*	-.15	.05	.12	.08	.06	.72	-.33	.01	-.04	-.11	.12	-.27	.93
STC182	% MATRICS MAJORED IN SMALL LOCATION	-.23	-.20	.14	.09	.04	-.04	.70	-.43*	.02	-.19	-.01	.02	-.19	.88
STC191	RAT: ACCEPTANCE OFFERS PER ENTERING STUD	.11	-.23	-.04	-.02	-.06	-.09	-.23	.78	-.05	.00	.11	-.12	.20	.80
STC126	ADMISSION ODDS	-.25	.05	.02	.25	-.12	.17	.20	-.72	-.10	.07	-.22	.00	-.22	.84
INR002	CONTROL: 0=PUBLIC, 1=PRIVATE	.18	-.21	.04	-.43*	.01	-.10	-.34	.46	-.16	-.04	.00	-.18	.21	.69
STC372	MED DEV MCAT.VERBAL MATRC.TOTAL	-.02	-.04	.03	.18	.04	.03	.23	-.14	.78	-.11	.08	-.08	.10	.76
STC373	MED DEV MCAT.SCIENCE MATRC.TOTAL	-.06	-.12	-.13	.10	.04	.11	.04	.06	.76	.16	.05	-.10	.19	.71
STC374	MED-SCHOOL EXPECTANCIES IN MCAT IN 76-77	-.26	.09	-.10	.30	.03	.03	.14	.11	.41	-.22	-.01	.24	-.16	.53
STC153	ADM ODDS RATIO FOR CAREER IN RES & TCH	.17	-.13	.07	.01	-.18	-.08	-.19	.05	.05	-.60	.32	-.01	.05	.60
STC190	1ST-YR CLASS ANNL GROWTH RATE 1970-75	-.23	-.01	.01	-.07	-.07	-.01	.09	-.13	.02	.54	.14	.04	.09	.42
STC172	% MATRICULANTS WHO ARE FEMALE	.31	-.25	-.18	.07	.28	-.20	-.21	.13	.13	.49	-.20	.13	.30	.78
STC129	ADMISSION ODDS RATIO IF FEMALE	.11	-.19	.01	.05	.41*	-.18	-.19	-.01	.32	.42	-.20	.12	.36	.75
STC178	ADM ODDS RATIO FOR BASIC SCIENCE SPECIAL	.28	.05	.06	.07	.06	-.14	-.26	.15	.13	-.03	.78	.17	-.09	.81
STC180	% MATRICS SEEKING SPECIAL IN BASIC SCI	.49*	.06	.03	.02	.01	-.14	-.17	.17	.01	-.00	.73	.06	-.02	.87
STC119	% ALL 75-6 RESDNTS IN GP FM IM OR PED	-.07	.07	-.04	-.06	-.03	.03	.14	-.08	-.11	.10	.12	.84	.07	.80
STC175	% MATRICULANTS FROM UNIVERSITY SUBCITIES	-.03	-.10	-.04	.05	-.05	-.01	-.09	.07	-.00	.04	-.00	.10	.89	.84
STC136	ADMISSION ODDS RATIO IF UNDERREP MINOR.	.19	.02	-.07	-.04	.07	.00	-.13	.21	.03	-.05	-.07	.75	.80	.80
STC145	NUMBER OF MATR-APPL SCHL GPA DIFFERENCE	-.01	.43	.03	.14	-.08	-.15	.05	-.11	-.14	.09	.14	.14	-.88	.77
	COLUMN SUM OF SQUARES	8.36	3.28	3.73	3.97	3.40	3.70	5.69	3.05	2.36	2.06	1.95	1.57	2.89	
	PERCENT OF VARIANCE	18.17	7.13	8.11	8.63	7.39	8.03	12.36	6.63	5.13	4.48	4.25	3.40	6.28	

understandable since the seventh component seems to consist of variables related to a school's preference for persons seeking careers in primary care. There are 12 variables with primary loadings on the first component, and seven variables, from other principal components that have secondary associations with an institution's research/academic orientation. Additional instruction in the interpretation of entries in a factor pattern matrix is given in Appendix B.

The 58 variables formed 13 groups that seem to reflect distinct and empirically independent ways in which medical schools differ from one another. These principal components of variation are based on the admission actions taken by the schools (and by their applicants) and may or may not reflect deliberate policy differences, different historical development, or, in some cases, meaningless random (chance) variation. Each of the thirteen groupings is discussed in the following sections. It should be kept in mind that the analysis is exploratory and that all interpretive observations are strictly tentative hypotheses.

(1) Academic Selectivity and Research

As characterized by the variables named in the first twelve lines of Table 2, the first principal component seems to describe the extent to which a medical school selects and trains its students for potential research careers. Such schools may be typified by relatively greater percentages of recent graduates in research or teaching positions and smaller percentages involved in patient care (note negative loading). Schools with a high value for this component expend relatively greater amounts of funds in sponsored research activity. On the average, schools at the high end of this continuum receive better (lower) priority score assignments on their research grant applications. Their alumni are more likely to be on the faculty of a medical school. The research intensive schools characterized by this component also tend to have more graduate medical education involvement in proportion to the size of the undergraduate medical program than do typical schools.

Students enrolling in the schools high on this continuum are likely to have also received acceptance notices from other schools. More of these students indicated an interest in a career in academic medicine or a desire to specialize in one of the basic sciences. On the aver-

age, they tend to have exceptionally high MCAT scores and pre-medical grades. It is less likely, than is typical for all schools, that these new students had re-applied to medical school or had re-taken the MCAT. Finally, the first principal component indicates that holding an M.A. or Ph.D. does not appear to better one's chances for admission to a research-oriented medical school.

(2) Size and Choice

The second component consists of five variables, most prominent being the number of medical students at a school, indicating the size of the undergraduate medical program. The factor loadings indicate that larger schools have larger amounts of regular operating revenues. Large schools also have the highest values of the indices of difference between applicant MCAT scores and matriculant MCAT scores. It appears that the schools that discriminate most on the basis of test scores are the larger schools. Since larger schools probably receive larger numbers of applications and a wider range of applicant test scores, the opportunity to select persons with higher scores may be greater. Alternatively, the necessity of screening excessive numbers of applications may lead to a greater reliance on test scores.

Although the indication is not strong, it appears that larger schools that rely on test scores have smaller proportions of graduates entering the primary care fields of general practice, internal medicine or pediatrics.

Some of these exploratory observations may be due, at least in part, to the nature of the measures used. The indices of difference between applicants and matriculants are not completely independent of enrollment as would have been desirable. Future studies may eliminate this deficiency by constructing a different index.

(3) Biological versus Physical Science Preparation

Several of the 58 variables analyzed pertain to the undergraduate major fields of applicants and matriculants. Table 1 showed that the average matriculating class consists of 60.0 percent pre-medical and biology majors and 22.1 percent physical science and math majors (who presumably also studied subjects prerequisite to medical training). The third principal component of institutional variation suggests that schools that show exceptional preference to students with biological science training also show less (than average) willingness to accept

students with physical science backgrounds. These relative preferences appear to be independent of admission preferences for majors from the social sciences and humanities (see section (5), below).

The correlation between the admission odds ratio for one major and the percentage of matriculants who had that major may be to some degree artifactual. It is understandable that schools evidencing preference for certain types of applicants would tend to enroll greater than average proportions of such persons.

(4) Fathers in Professions

The percentage of matriculants whose fathers are medical doctors ranges from 2.7 percent at one school to 29.5 percent at another. The tendency to matriculate disproportionate numbers of sons and daughters of fathers with graduate and professional education, component four, appears to be independent of the academic preparation of the matriculants, component one. The tendency to matriculate offspring of the educated does, however, appear to be more characteristic of private schools, since the loading of "public versus private" variable is related to this component and only one other.

(5) Social Science and Humanities Preparation

The fifth principal component consists of four variables that describe the odds and percentages for matriculating persons with undergraduate majors in the social sciences and humanities. Institutions showing evidence of such a preference are not necessarily the same institutions with a predilection for or against biology or physics majors.

(6) Re-Applicants and Age

Persons who have been rejected by medical schools in one year usually have a lower chance of admission in a subsequent year than do first-time applicants. The sixth component indicates that schools where re-applicants stand a better-than-usual chance of admission are also schools that are more likely to admit persons holding advanced degrees, and less likely to show a significant difference between the mean age of the applicant pool and the mean age of the matriculants.

It may simply be that some rejected applicants who

re-apply to medical school spend the interim in advanced study in universities. They take the MCAT again. They also get older. There are no consistent characteristics of schools that have greater than average acceptance rates for such persons, except that they are not likely to be the strong research schools.

(7) Primary Care Orientation

In recent years public attention has focused on the continuing need for more primary medical care and for better distribution of physicians' services to persons in rural settings. The seventh principal component of institutional variation shows that the tendency for a school to matriculate persons raised in places of low population, indicating an interest to return to a small place, or expressing a desire to have a primary care practice is not strongly related to other dimensions of institutional difference. The research (first) component, however, has small but consistently negative loadings from all seven variables that constitute this component, indicating a possible inverse relationship between research and primary care training. Other secondary loadings suggest that public medical schools tend to enroll larger-than-average percentages of persons seeking a rural and/or primary care career.

(8) Admission Odds and Type of Control

Admission odds was computed as the ratio of the number of matriculants to the number of applicants who did not matriculate. It expresses the chance that an applicant to a given school will matriculate at that school. It appears, in component eight, to be related only to whether a school is public or private. The chance of matriculation, it seems, is higher at public schools. Public medical schools tend to receive fewer applications per opening. Their applicant pools may tend to be smaller because they reserve most of their places for in-state residents. Non-residents are less likely to apply.

It was anticipated (in Chapter II) that the ratio of the number of acceptances a school makes to the number of openings in the next class would indicate the relative attractiveness of the school to better applicants who are accepted by several schools. In the eighth component, this ratio appears to be related to admission odds. Schools where admission competition

among applicants appears to be stiffest are also schools that make the most acceptance offers per opening, that is, that seem to be competing with other schools for the best students. As observed above, these tend to be private schools.

The other anticipated indicator of institutional attractiveness, the percentage of matriculants who had also been accepted elsewhere, was found to be related to academic selectivity and research intensiveness (component one, above).

(9) Variation in Academic Preparation

Variation in the academic preparation of first-year students, reflected in the standard deviations of their MCAT science and verbal scores, does not appear to be related to other major institutional characteristics. There is a weak indication that schools participating in the AMCAS program enroll students having greater range of academic preparedness. This could be a result of greater size and mixed composition of their applicant pools.

AMCAS participation does tend to increase the number of applications a school receives. It does not appear, however, to have biased the pattern of correlations among variables analyzed in this exploratory study.

(10) Women and Growth

The factor loadings are all of modest size in the tenth principal component. Possible interpretations of the variables are tenuous but interesting.

It appears that schools now giving relative preference to the admission of women may be schools that have recently expanded their total enrollment. The simple correlation between recent growth and admission odds ratio for females is .78. The simple correlation between growth and percentage of new matriculants who are women is only .12. A number of interpretations are possible. It could be that schools trying to expand enrollments and to maintain adequate representation of women must give some preference to the limited numbers of women in their applicant pools. It could also be that, to some extent, expanded enrollment created additional places for women. (It should be remembered that all schools in this study were founded prior to 1961.)

The loadings also indicate, though tenuously, that schools admitting more women are schools that show less acceptance of students seeking careers in research and teaching. It could be that women are less likely to opt for research careers. These schools also appear to be somewhat less likely than the average school to enroll humanities and arts majors.

(11) Basic Science Specialization

Admission preference for applicants indicating an interest in specializing in the basic science foundations of medicine appears to be unrelated to other characteristics, except, of course, the percentage of such persons enrolled.

(12) Residencies in Primary Care

Data from a 1976 ad hoc AAMC survey of medical school residencies were used to compute the percentage of residency positions in general, family, internal, or pediatric medicine. This characteristic of graduate medical education programs does not appear to be strongly related to any characteristics of admissions to the undergraduate medical program.

A secondary loading shows that the proportion of residencies in primary care fields may be weakly related to the proportion of undergraduates who eventually specialize in primary care. It may be that schools with higher-than-average proportions on these variables retain some of their own graduates for residency training.

(13) Minority Representation and Grades

The last rotated principal component shows that medical schools enrolling higher-than-average proportions of underrepresented minority students evidence the least discrimination on the basis of applicants' undergraduate grade point averages. The correspondence between these variables is weaker than many of the other possible relationships highlighted in this study.

Summary

Thirteen principal components provided a descriptive summary of the variation among medical schools on 58 selected measures. The identities of variables loading together on each of these dimensions provided grounds

for speculation about possible interrelationships between the admissions process and other characteristics of the medical school.

Chapter IV

CONCLUSION

Caveat

This study of admissions preferences, like other studies in the series, was exploratory, designed to stimulate hypotheses rather than to answer specific questions. The method of analysis was to apply objective quantitative techniques to facilitate subsequent subjective interpretation. In view of this condition, any observations must be considered tentative and best expressed as questions or hypotheses about variation in medical school admissions practices and, occasionally, about the data collected to study their operations.

Observations

Based on the discussion in the preceding Chapter, the following observations seem warranted:

- Schools that accept the most highly academically qualified students are likely to have a research emphasis. Selected students are less likely to be re-applicants or holders of advanced degrees. Their graduates are more likely to serve on medical school faculties.

- Selectivity on MCAT scores appears to be related to size of undergraduate medical program. It may be that schools that process the largest numbers of applications place greater reliance on text scores for initial screening. The observation may also be due, in part, to the nature of the indices used. There were weak indications that these schools graduate small proportions of persons who will deliver primary care.

- Private schools are more likely than public schools to enroll students whose fathers are medical doctors. This is independent of another principal component that describes the academic preparation of new students.

- Schools enroll varying proportions of students who were biology/pre-med, physics/math or social science/humanities undergraduate majors. At different institutions there appears to be a trade-off between admissions

majors is independent of this apparent relationship

- Schools vary in their acceptance of re-applicants to medical school. This dimension of difference does not seem to be strongly related to variables independent of students' mean age.

- Public medical schools may be more likely than private schools to enroll students desiring careers in primary care or contemplating practice in small or rural places. More of their students also tend to be from small towns.

- Schools where admission competition among applicants is greatest are schools that appear to compete among themselves for the best students. These schools offer more acceptances for each opening they have to fill. These tend to be private schools.

- Although the results are tenuous, it appears that well-established schools that have recently expanded their enrollments are schools that give some preference to the admission of women. It could be that expanded enrollment created additional places for women.

- The percentage of a medical school's residency positions in primary care specialities appears to be at best weakly related to the proportion of graduates from the M.D. program who eventually specialize in primary care fields.

- Schools that admit greater proportions of minorities currently underrepresented in medicine appear to give less importance to grade point averages as an admission criterion.

Further Study

An issue of current concern in the United States is the training and distribution of providers of primary medical care. It was observed in the present study that the percentage of medical school matriculants who indicate an interest in primary care practice varies across schools from a low of 22 percent to a high of 65 percent, with a mean of 45 percent. The admission odds ratio for such applicants varies across well-established schools from about .51 to 1.27. The percentages of matriculants desiring to locate in a small town range from 16 percent to 76 percent. This variation among medical schools was

largely independent of other ways in which medical schools differ from one another.

In particular it was found to be independent of the most prominent dimension along which medical schools were observed to vary in this study, the academic preparation of matriculants and the extensiveness of sponsored research activity.

It is possible to use some of the data from this study to observe the joint distribution of medical schools with respect to both (a) acceptance of primary care oriented students and (b) the existence of research oriented programs. This is the subject of another study in this series. (Sherman and McShane, 1977).

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APPENDIX A

Abbreviations Used in Variable Labels

Symbol	Definition
ADJ	ADJUSTED
ADM	ADMISSION
ADV	ADVANCED
ALUMS	ALUMNI
AMA	AMERICAN MEDICAL ASSOCIATION
AMCAS	AMERICAN MEDICAL COLLEGES APPLICATION SERVICE
ANNL	ANNUAL
BCPM	BIOLOGY, CHEMISTRY, PHYSICS,
BIOL	BIOLOGY
DEV	DEVIATION
DIFF	DIFFERENCE
EDUC	EDUCATION
ELSEWHR	ELSEWHERE
EST	ESTIMATE
EXPD	EXPENDITURES
FAC	FACULTY
FATH	FATHER
FM	FAMILY MEDICINE
FRS	FACULTY ROSTER SYSTEM
FT	FULL-TIME
GP	GENERAL PRACTICE
GRADS/GRD	GRADUATES
IM	INTERNAL MEDICINE
INDIC	INDICATE
LOC	LOCATION
MATR-APPL	MATRICULANT MINUS APPLICANT
MATRC/MATRICS	MATRICULANTS
MD	MEDICAL
MINOR.	MINORITY
NIH	NATIONAL INSTITUTES OF HEALTH
OPER	OPERATING
PED	PEDIATRICS
PHYS	PHYSICS
PRF/PROF	PROFESSIONAL
RAT	RATIO
REG	REGULAR
RES	RESEARCH
RESDNTS	RESIDENTS

Symbol	Definition
REV	REVENUES
SCH	SCHOOL
SCI	SCIENCE
SCR	SCORE
SPCLZN/SPEC	SPECIALIZATION
SPON/SPONS	SPONSORED
STD	STANDARD
STUD	STUDENTS
TCH	TEACHING
TOT	TOTAL
UNDERREP	UNDERREPRESENTED

APPENDIX B

Interpretation of the Factor Pattern Matrix

An understanding of the interpretation of the numerical "loadings" that comprise the factor pattern matrix facilitates the assessment of the results of the factor analysis used for the exploratory purposes of these studies.

The numbers in a table of "factor loadings" are measures of strength of association between the variables and the derived "factors". Like correlation coefficients representing the relationship between pairs of simple variables, they range in value from +1.0 to -1.0. Values near zero represent "no relationship"; values near +1.0 or near -1.0 represent strong positive and strong negative relationships respectively. The first row shows how strongly the first variable is related to each factor. Because of the rotational criterion, any one variable is probably highly related to only one or two factors and weakly related, at best, to the other factors. For purposes of speculation it is assumed that variables related to the same factor are likely to be related to each other.

For ease of examination, the variables in the table are often ordered according to their highest factor loadings. The predominant loading (or loadings) for each variable are highlighted with a "box" (for high values) or an "asterisk" (for moderately high values). The grouping of variables means that they may be related to one another, that is, their values vary the same way across institutions. At any given school, high standardized values of one variable tend to be matched with high values of the other, low with low, if the relationship is positive, that is, if the signs on the loadings are the same (both "plus" or both "minus"). If the signs of two variables' loadings are different (one "plus" and one "minus") the relationship is probably negative, that is, high standardized values of one variable are matched with low values on the other. Because the factors are numerically independent of one another (due to the rotational procedure used), it is also likely that the variables in one group have low correlation with variables in another group. Exceptional variables are readily seen.

By way of additional guidance in the interpretation of the factor pattern matrix, two additional rules of thumb may be useful. First, factor loadings with value less than about .50 (in absolute value) should not be given as much attention as larger numerical loadings. Second, variable groupings that account for small percentages of overall variance (given at the bottom of each column) may be less accurate indicators of potential relationships than groupings accounting for greater percentages of variance.

Whereas the named "factors" may be conceptually or mathematically independent and most variables related only to one factor, some individual variables may be found to be related to more than one factor. This may be more easily understood through a simple analogy. If, instead of medical schools, rectangles were the unit of study, height, width, and area might be among the measured variables. As a result of analysis, height and width may be found in a common factor with area, but, since height and width are independent of each other, one or both may also be found in additional factors (variable groupings).